

soles—points which have caused Drs. Baird* and Coues† to separate that species as a subgenus *Oryzomys*. It differs strikingly, however, not only in size and coloration, but in the long and nearly naked tail. In the latter it rather agrees with the forms named *H.* (*Tylomys*) *nudicaudus* by Dr. Peters‡ and *Neomys panamensis* by Gray§; but these have a different type of skull, the supraorbital edges being produced laterally instead of vertically. From the character of the feet, I should expect that *H. couesi* would prove to be at least partially aquatic in its habits.

3. On the Chinese Deer named *Lophotragus michianus* by Mr. Swinhoe. By A. H. GARROD, M.A., F.R.S., Professor to the Society.

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(Plate LXXVI.)

At a meeting of this Society in 1874 (P. Z. S. 1874, p. 453), Mr. R. Swinhoe described a small Deer sent him from the neighbourhood of Ningpo by Mr. Michie, of Shanghai, and gave it the name *Lophotragus michianus*, after its discoverer. The specimen consisted of a skin, without the skull or any other bones. Mr. Selater, at the time, suggested that it might be the *Elaphodus cephalophus*, which had been described shortly before|| by M. Alphonse Milne-Edwards from specimens obtained by Père David in Moupin. Mr. Michie informed Mr. Swinhoe that the specimen was a female; and Dr. Peters, of Berlin, who carefully examined it before it was mounted for the national collection in that city, has courteously answered questions which I put to him with reference to it (the type) in the following words:—"It does not show a trace of horns. . . . It shows *well-developed* teats, and not a trace of a penis; there is no trace of an impression on the lower lip, as would have been the case if it had been furnished with the male tusks, figured from imagination in Swinhoe's figure." From what will be said further on it can be evidently inferred that the type specimen is a female.

A second specimen, a living male, of the same Deer was purchased by the Society on February 12th last from Mr. Michie's agent. It also came from the Ningpo district. Mr. Selater's note with reference to it, together with a woodcut of the animal, will be found in the 'Proceedings' for this year (*anteà*, p. 273). In this he tells us that "the canines project from the sides of the mouth, as in *Hydropotes*. There are no external antlers; but there are hard

* Mamm. N. Amer. p. 458.

+ Proc. Acad. P. ilad. 1874, p. 183

† Monatsb. Ak. Berlin, 1866, p. 401.

§ Ann. & Mag. Nat. Hist. 4th ser. xii. p. 417.

|| Nouv. Arch. du Mus. 1874, Bull. p. 93.

projecting cores, sensible to the touch, beneath the elongated hairs which form a flattened disk on the forehead.”

Shortly after its arrival the animal began to show symptoms of paralysis, which led to its death on the 14th of July. The following are measurements made a few hours after its death, before any incisions had been made :—

	inches.
From tip of nose to base of tail.	36
Fleshy tail	3
Length of head	$9\frac{1}{2}$
Length of ear	$5\frac{1}{2}$
Greatest breadth of ear	$3\frac{1}{2}$
From the middle line of the back straight down to the elbow	10
From the elbow to the wrist	$5\frac{1}{2}$
From the wrist to the base of hoofs	$6\frac{1}{2}$
From the middle line of back straight down to the knee	$11\frac{1}{4}$
From the knee to the ankle	9
From the ankle to the base of the hoof . . .	10

A minute examination of the skull and skin of this specimen, in association with the description and figures given of *Elaphodus cephalophus*, made it quite evident to me that Michie's Deer is of the same genus as it; and I wrote to M. Milne-Edwards to ask him some questions of detail with reference to the Moupin species. In reply that gentleman told me that, besides the specimen figured by him, he has two other skins of the same species in very bad condition, which much resemble *Lophotragus* in their colour, and that he believes they clearly show that the species is variable in its coloration, and that the Deer described by Mr. Swinhoe is the same as that obtained by Père David. At the same time he very courteously sent me the two skins above mentioned, from the larger (male) of which the figure of the skull given by him was taken, and also gave me permission to remove the skull from the smaller (young female) skin. This I have done, and find that in age it is exactly the same as the Society's specimen.

A comparison of the skins makes it immediately evident that the animals from Moupin and those from Ningpo scarcely differ from one another at all, and that *Lophotragus michianus* and *Elaphodus cephalophus* are the same species, slightly modified in accordance with the difference in their habitats.

The following description of the species may serve to render its characteristics more apparent :—

Elaphodus cephalophus is a Deer of about the same size as the Indian Muntjac (*Cervulus muntjac*), with minute simple antlers, which are situated on slender convergent pedestals; and with enormous canine teeth. The supraorbital glands, found in the Muntjacs, are not present; nor is there a tufted gland on the outside of the metatarsus.

The hair is coarse and slightly quill-like. In the Moupin specimens it is of two kinds as regards general coloration—all in front of a vertical line drawn through the shoulder-joint, with the exceptions to be mentioned below, being whitish at the base, and gradually becoming dark-brown towards the tip, quite close to which there is a distinctly marked narrow *white* ring. This white ring near the extremity of each hair gives a speckled appearance to the parts covered with it.

Over all the body behind the above-mentioned line this white ring is absent; and each hair, from being white at the root, gradually darkens to become of a rich brown at the tip, over the sides and back of the animal, more pronounced along the middle line—at the same time that, whilst deepening in intensity down the legs, below the carpus and tarsus the colour is almost black itself, as are the hoofs. In the female figured by M. Milne-Edwards, which is of a more rufous tint generally than the pair of skins lent by him to me, there is, as is sometimes the case in *Cervulus reevesi*, a white line just above the hoofs.

The under surface of the tail is white, as is also the hair in the pudendal region.

Much resembling, though more developed than in the females and the young males of the genus *Cervulus*, there is a crest of lengthy deep-brown, almost black hair arranged in a horse-shoe shape in the frontal region. It is anteriorly that the crest is deficient, the short speckled hair of the nose extending backwards, at the same time that it lengthens, to enter the interior of the enclosure thus formed. This crest is slightly prolonged between the ears as a pointed process, with the equally dark hair of the base of the exterior of which it does not blend, a narrow speckled isthmus intervening. M. Milne-Edwards tells us* that the interior of the ears is whitish, and that the tips of these organs, as well as the greater part of their inner edge, are of a nearly pure white. A transverse black bar extends across the inner surface of the ear, about three quarters of an inch broad. Along the lateral margin of the outside of the horse-shoe crest the short hair forms a light grey line in front of the eye, becoming reddish brown behind it. The long hair of the crest itself is directed backwards.

In the young male specimen from the hills near Ningpo which forms the subject of the present paper, the only hair which is ringed is situated in the front of the base of each ear, occupying an extremely small area. Elsewhere the chocolate-brown of the Moupin examples is replaced by greyish-black, each hair being white for a considerable distance from its base. The face and neck are therefore not speckled or brown, but uniformly dark grey. The head is figured, as it appeared immediately after death, in the accompanying drawing (Plate LXXVI.).

The *skull* of the Ningpo *Elaphodus* cannot be said to differ essentially from the Moupin specimens. Although there are exquisite figures in the 'Recherches pour servir à l'histoire Naturelle des Mammifères' † of the skull of the adult male, M. Milne-Edwards has most

* *Loc. cit.* p. 355.

† Atlas, pls. 66 & 67.

obligingly allowed me to remove the cranium from the skin of the female that he has lent me, which fortunately happens to be of exactly the same age as the Society's male; in other words, the median milk-incisors are gone, whilst the third molars are just protruding, all the milk-molars being in place. In the Society's specimen the frontal pedestals are fairly long, but without any antlers at their extremities. Their bases are slightly further from one another than in the Moupin male; and there is a second slight difference from both it and the female, which is, that just at the root of the ascending orbital process of the malar bone the ring of the orbit does not become ossified upwards so as to reduce its size by the formation of a shallow lamina above the masseteric ridge. This peculiarity may also be expressed by saying that the surface of origin of the masseter muscle extends upwards as far as the margin of the orbit in the Ningpo male, whilst in those from the more western locality it ceases some distance below it. But it must be noted that the Ningpo specimen died in very bad condition, the bones being spongy and ill-marked*, whilst the others were shot wild. In it, strangely enough, there is also an abnormality with which I am not at all acquainted. It is that the malar bones on both sides, instead of being single, are made up of two independent parts, an orbital and a zygomatic, with the suture longitudinal and nearly straight, extending from the anterior extremity of the zygomatic process of the temporal bone to the posterior inferior part of the large cruminal depression.

Sir Victor Brooke†, in his paper on the *Cervuli*, has drawn attention to the very peculiar distribution of the ankyloses in the tarsus of that family, he having demonstrated that in it the external and middle cuneiform bones blend with the naviculo-cuboid to form a single bone. The same condition exactly exists in *Elaphodus cephalophus*, the innermost cuneiform bone remaining free. But, strange to relate, in my specimen of Michie's Deer, on both sides, this internal cuneiform bone is completely ankylosed with the metatarsus, a further specialization than is found in any other ruminant, so far as I can make out.

In Michie's Deer no trace of the lateral metacarpal rudiments could be detected. It possesses thirteen pairs of ribs, six lumbar vertebræ, six ankylosed sacrals, and nine caudals, making forty-one

* The following are the measurements of the skull of the Ningpo male, side by side with which those of the male (adult) Moupin specimen are given, from M. Milne-Edwards's figure:—

	Ningpo spec. in.	Moupin spec. in.
Extreme length of skull	$6\frac{3}{4}$	$7\frac{1}{8}$
Extreme breadth from zygoma to zygoma ..	$3\frac{1}{32}$	$3\frac{7}{32}$
Interval between inner sides of frontal pedestals ...	$1\frac{3}{32}$	$1\frac{1}{4}$
Extreme length of nasal bones.....	$2\frac{3}{8}$	$2\frac{1}{4}$
Breadth of facial plane opposite lacrymal foramina	$1\frac{2}{32}$	$2\frac{1}{32}$
Mandible from angle to incisor margin	$5\frac{1}{2}$	$6\frac{1}{2}$
Extreme length of premaxilla.....	$1\frac{2}{32}$	$2\frac{5}{32}$
Extreme intermolar breadth	$1\frac{1}{4}$	

† P. Z. S. 1874, p. 33.

vertebræ in all. The bones, in the specimen under consideration, especially those of the limbs, are extremely porous and badly marked; nevertheless, on making a section of the head of the metatarsus, it is apparent that the internal tarsal cuneiform bone has so completely fused with it as to leave no line of demarcation. In the Paris specimens of *Elaphodus* the tarsus exactly resembles that of *Cervulus*, and the lateral metacarpals are very nearly lost.

In the young female from Moupin the milk canine teeth are in place, their permanent successors appearing, in the dry skull, above them. In the male of the same age from Ningpo, the tusks have a remarkably permanent appearance, and there is no evidence from the condition of the maxillary bones that they belong to the milk series. Such being the case, it must be presumed that the milk canines in the male are shed earlier than in the females, as it is not in accordance with any known facts that they should have persistent pulps which would remove any necessity for their replacement.

Anatomy of the Alimentary Canal and other Viscera.

The muzzle is more considerable than in the Elaphine Deer, but resembles that of the *Rusinae* and Muntjacs in extending upwards along the outer border of each nostril as far as its superior margin. The canine tusks protrude an inch below the upper lip, and mark the lower lip at the spots at which they come into contact with them.

The *palate* in front of the intermolar region is transversely ridged by folds of the mucous membrane, slightly crenulated at their free backwardly directed edges. These folds are deficient in the middle line; and those on one side are not continuous with those of the other, but with the spaces which intervene between them. The intermolar region and the palatal surface behind it are smooth, and black instead of flesh-coloured, as it is anteriorly.

The *tongue* is like that in most ruminating animals, broad near the tip, then narrower, and again slightly broader opposite the intermolar eminence. Its mucous membrane is covered with two kinds of papillæ—first the filiform, small, thick-set, short and blunt over the anterior part of the organ, conical and larger in the middle of the intermolar eminence, and secondly the fungiform, disk-shaped and flattened, scattered sparsely over the fore part, and at the sides of the intermolar eminence gradually enlarging and becoming arranged in a linear manner, converging as they run back to form the circumvallate papillæ, eleven on one side and twelve on the other.

The salivary glands present no special features of interest. The tonsils open each by an orifice situated in the middle of a slight depression. The epiglottis is rounded, with a slight notch in the middle line of its contour.

The *stomach* possesses much the proportions of that of the Musk (*Moschus moschiferus*)*. In the *ruen* perhaps the converging left lateral cæcal extensions of the upper and lower compartments are slightly longer. The villi are there very close-set, elongated, flat-

* *Vide* P. Z. S. 1875, p. 168.

tened, and slender, with nearly parallel sides, the largest being slightly spooned at their free ends. In most parts they are about a quarter of an inch long; but on the folds they are much shorter. Nowhere are they absent. They are all blunt-tipped and slightly crenulated along their margins. No trace of the special gland found by Prof. Flower on the anterior wall of the paunch of the Musk could be detected. Neither in *Cervulus muntjac* nor in *C. reevesi* are the villi of the rumen flattened, they being cylindrical. The cells of the *reticulum* are shallow and not large, covered with minute papillæ on their floors, and with a regularly arranged row on the top of each cell-wall.

The *psalterium* resembles that of the ordinary Deer, and differs from that of *Moschus* in that the plicæ are unequal in length. There are thirteen folds of what may be termed the first power, because they are the deepest, between each two of which one of the second power is developed. On each side of each secondary fold is a tertiary, about a quarter of an inch deep; and, again, there is a longitudinal row of papillæ on each side of each tertiary fold, which may be considered to be a rudimentary set of the fourth power. Such a psalterium may be called *quadruplicate*, because folds are present of four different depths. The stomach of *Moschus* would be simpliciplicate, were it not that there is a row of papillæ developed between the plicæ in some parts; it is therefore duplicate upon the nomenclature here suggested.

The *abomasum* presents no peculiarities.

The following are the measurements of the intestines:—

	ft.	in.
Small intestine	23	2
Large intestine	9	8
Cæcum	9	$\frac{1}{4}$

The colic coil was not disposed in quite the ordinary manner; but the peculiarity was probably an individual one. At its end the large intestine made a complete transverse reduplication before turning forward from the right iliac fossa to form its terminal and irregular curve round to the sigmoid flexure.

The *spleen* is flat on one side, domed on the other, and circular.

The *liver* is composed of two nearly equal lobes, from the abdominal surface of the right of which is developed the triangular and laterally directed caudal lobe. The Spigelian lobe is only rudimentary, being represented by a slight tumefaction of the vertebral border of the portal fissure. There is no gall-bladder.

In the arteries of the neck the arrangement is that found in the Ruminantia generally, the ascending aorta giving origin, first to the left brachial with the corresponding vertebral, then to the left carotid, and finally to the same three vessels of the right side.

There are thirty-eight tracheal rings above the accessory bronchus, and nine below it, making forty-seven in all. In the lungs the two lobes of the left side and the five on the right were found, the right lung being the larger. The lower lobe of each lung is comparatively small.

The *brain* (figs. 1 and 2) is richly convoluted for its size, its measurements, after having been hardened in spirit, being:—

	in.
Greatest length of hemispheres	$2\frac{1}{2}$
Greatest depth of hemispheres	$1\frac{1}{2}$
Greatest breadth of brain	$2\frac{3}{16}$

It is therefore somewhat larger than in *Cercus humilis*,^a as may be

Fig. 1.

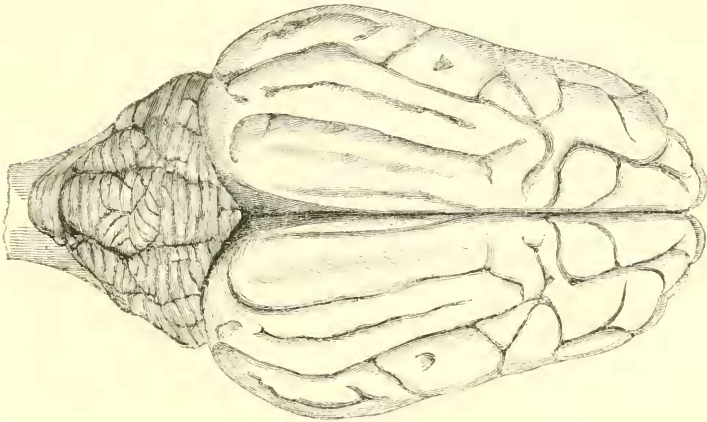
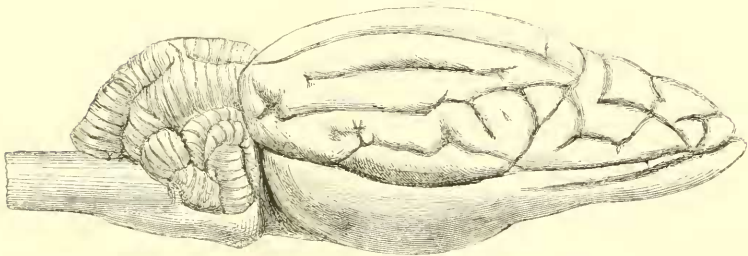


Fig. 2.



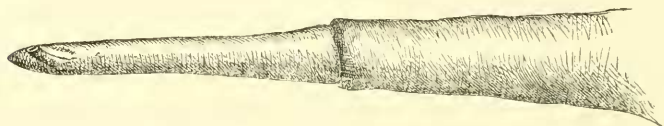
inferred from the measurements given by Professor Flower*. This species it also closely resembles in its convolutions, as well as in the considerable development of the anterior lobes. The hippocampal, inferior external, together with superior and middle external gyri, are easily recognizable, the sulcus separating the last two being long, and the middle external gyrus traversed in the direction of its length by

* P. Z. S. 1875, p. 176, note.

a minor sulcus. There is a break in the sulcus which separates the middle and inferior external gyri a little more than an inch from the anterior border of the hemisphere, which is peculiar. As in *Moschus* and in *Cervus humilis*, the calloso-marginal sulcus appears on the superior surface of the brain, allowing the hippocampal gyrus to appear between it and the middle line. In *Cervulus muntjac* the convolutions are slightly less developed than in Michie's Deer, and the calloso-marginal sulcus is even more superficial; it is, however, narrower anteriorly.

In its *generative organs*, the glans penis (fig. 3), instead of being blunt, is an elongated and slender cone, terminating much like the tip of a wooden pen-holder, the urethral orifice being situated just behind the extreme tip, slightly turned upwards. The Muntjacs and the

Fig. 3.



Roe Deer agree with Michie's Deer in the shape of the glans; but whereas there is no trace of Cowper's glands in *Capreolus* and Michie's Deer, they are large in *Cervulus* (in *C. muntjac* at least). There are four nipples. On the outside of the skin covering the metatarsus I found in the recently dead animal a deep smegma-secreting depression, evidently homologous with the metatarsal glands in most Cervidæ. There were no tufts of hair round these; and I cannot recognize their situation in the prepared specimen of the skin.

General Remarks.

From what has been said above, it is evident that the *Lophotragus michianus* of Swinhoe is the same animal as the earlier-named *Elaphodus cephalophus* of A. Milne-Edwards, and that it was because his specimen was a female in which the skull was wanting, at the same time that the figure given by M. Milne-Edwards is from a remarkably light-coloured and red skin, that Mr. Swinhoe was misled as to its affinities. It seems, however, that the Ningpo animal is of a greyer tint than that from Moupin; for the description given by Mr. Michie*, namely that "it is a dark iron-grey or pepper-and-salt colour, like some Scotch terriers," exactly applies to the Society's example, whilst the Paris skins are all decidedly chocolate, although differing in tint among themselves.

As to the affinities of *Elaphodus cephalophus*, M. Milne-Edwards† has remarked that "it is intermediate between the Muntjacs and the ordinary Deer, in certain respects appearing even to unite these animals to *Hydropotes* and *Moschus*."

That *Moschus* has any close affinities with *Cervulus* and its allies is extremely doubtful; and a comparison of the above description of

* P. Z. S. 1874, p. 453.

† *Loc. cit.* p. 353.

